is a few miles north of Boston. This same meteor was seen to pass over the city of Springfield, about ninety miles west of Boston, and according to newspaper reports "its glare lit up the earth as bright as day," "the hissing of the fiery mass could be plainly heard in some sections," it had "a white head and a reddish tail of burning gases." The Springfield accounts state that a few seconds after its passage over that city it seemed to explode into particles which were burned or vaporized before falling to the earth. The Boston account indicated that it parted high up in the air, one piece dropping in a southwesterly direction. The piece that fell into the harbor is described as seeming to be of the size of the full moon. "Several small boats," so one account states, "were observed in the vicinity when one piece dropped into the water near Winthrop." It is unfortunate that if this was the case, the exact spot of the fall was not noted, as the water there is probably not more than a few feet deep, and the fragment, heated (as such bodies are) only externally in their flight, might be found almost intact in spite of its impact with the water. Moreover, it is probable that its velocity was well spent and that the water resistance would so far reduce the speed that it would not even bury itself in the earth below.

My personal observations in regard to this meteor are as follows: While journeying eastwardly from the direction of Pittsfield to Springfield with a party in an automobile we followed the road which runs approximately parallel to the Boston and Albany Railroad tracks east of the town of Huntington. At a point about a mile southeast of that town and about eighteen miles west of Springfield, with a clear sky but somewhat smoky air, we were startled by a very bright illumination of the landscape, like that given by an intense flash of lightning though much more prolonged. On looking upward at once for the cause, our attention was at once fixed upon a brilliant body descending rapidly and almost vertically, and apparently nearly overhead. It appeared to fall into the woods on a hill to the left of us. The light was remarkable as being of a pure and intense greenish blue, which continued at full intensity until the mass was lost to sight in the woods. This fragment of the larger mass which itself continued on east, appeared to me to owe its luminosity to an actual combustion in our air, as its velocity of fall was apparently much too low for it to have been maintained at a high temperature by air resistance. In fact our first impression was that it was falling almost directly upon us or might strike nearby; an impression confirmed by the appearance that although we were moving at moderate speed along a straight part of the road our horizontal direction of view was changing quite rapidly with respect to its line of descent. I am convinced that this was no illusion. The vivid green blue color of the light rendered the effect very beautiful.

It seems to indicate an unusual chemical composition, something which readily burned in the air and which at the same time gave a pure light, spectrum lines in the green and blue, or green-blue only.

ELIHU THOMSON

SWAMPSCOTT, MASS.,
September 24, 1908

DR. W. J. HOLLAND ON THE SKULL OF DIPLODOCUS

IN the second volume of the *Memoirs of the Carnegie Museum,* Pittsburg, page 225, Dr. W. J. Holland has written at considerable length on the skeleton of *Diplodocus.* Most of his original matter is based on the well-preserved hinder part of a skull that was found in Wyoming. On request Dr. Holland kindly sent me this skull for examination, and I have carefully compared it with the skulls of various reptiles, living and extinct. I regret that I find myself at variance with Dr. Holland as regards many of his determinations of bones and foramina in this skull; but it is essential that errors in such important matters be corrected as early as possible.

First of all it may be said that most of the sutures between the bones are far less distinct than they are represented in Dr. Holland's figures, and some of them do not appear to be where they are drawn.

Three pairs of bones forming the side walls of the brain-case have been identified by Dr. Holland as the exoccipitals, the alisphenoids and the orbitosphenoids. As to the exoccipitals, he is right. Nothing whatever is said by him about the prootics, although they are among the most important and constant bones of the reptilian skull. The fact is, however, that the bones regarded by our author as the alisphenoids are in reality the prootics, while his orbitosphenoids are the alisphenoids. The orbitosphenoids are only slightly developed and are thoroughly consolidated with the alisphenoids. That the bones called by Dr. Holland the orbitosphenoids are in fact the alisphenoids is shown by the presence of the optic foramina in front of them.

Dr. Holland has represented the supraoccipital bone as occupying a small lozenge-shaped area on the upper surface of the skull and narrowing to a point right and left. Now, in all reptiles this bone, by virtue of its epiotic element, takes an essential part in the formation of the internal ear, containing, as it does, the posterior semicircular canal. It must, therefore, come into contact with the exoccipital and the prootic not far above the fenestra ovalis. The three bones concerned are, in the Pittsburg specimen and all others known, thoroughly coossified and the sutures are nearly effaced. However, the writer believes that the suture between the supraoccipital and the exoccipital starts about 25 mm. above the fenestra ovalis and runs outward and backward to a notch in the hinder border of the posttemporal fossa. In Dr. Holland's figure 5 this suture would start from the suture ascending at the left of the letters *ex.o,* at the upper border of the postfrontal bone and run backward just below these letters, and end under the bone *sq.* The suture between the prootic (Dr. H.'s alisphenoid) and the parietal falls so low that it would properly be hidden behind the postfrontal. The line representing the hinder border of the parietal in the supratemporal fossa is, in that figure, directed too far to the rear as it descends. The letters *ex.o* lie on the supraoccipital. On the upper surface of the skull, the suture between the supraoccipital and the exoccipital probably starts on the midline, as represented by Dr. Holland's figure 4, and runs outward to the notch already mentioned and seen near the letters *AS.* The supraoccipital is thus given the importance that it has in the reptilian skull.

Dr. Holland has correctly identified the olfactory, the optic and the hypoglossal foramina, likewise that giving entrance to the internal carotid artery; as to the others, I believe that he is in error. The foramen assigned by him to the oculomotor nerve is situated between the alisphenoid and the prootic, which is just the place for the trigeminal nerve. Just below this there is, in the Pittsburg specimen, a group of three small foramina which are supposed by Dr. Holland to have given entrance to the anterior branch of the internal carotid. These foramina are below the floor of the brain-case and almost certainly opened into the pituitary fossa; and probably they afforded exit to the ophthalmic artery.

As already indicated, that foramen which Dr. Holland has identified as that for the trigeminal nerve is regarded by myself as the fenestra ovalis. It lies on the boundary between the prootic and the exoccipital, where the fenestra ovalis is to be sought. It is a trilobate opening, but in a specimen in the U. S. National Museum the anterior lobe is cut off by a bridge of bone. Here probably escaped the facial nerve. The base of the stapes was no doubt placed in the remainder of the opening.

The foramen for the internal carotid artery lies in the exoccipital near its anterior border. Just behind this comes the foramen called by Dr. Holland the fenestra ovalis. While not believing it to be this fenestra I can not, in the present condition of the skull, say with certainty what was its function. It seems probable that here, as in some other reptiles, the ninth nerve passed out through this foramen separately from the tenth nerve. The latter certainly escaped through the foramen marked by Dr. Holland with the Roman numeral IX. in his figures.

In speaking of his supposed fenestra ovalis

Dr. Holland says that he knows of no other opening through which the auditory nerve could escape from the brain cavity; but unfortunately he did not think it necessary to indicate the distribution of this nerve.

The writer knows of no fossil skull that is better fitted for section than the one described by Director Holland. Had it been divided along the median plane and had the matrix then been removed, much valuable information would have been secured. Probably some sutures that do not show on the rough outer surface would reveal traces of themselves on the inner surface; and important suggestions regarding some of the foramina would offer themselves. Especially, it would then be possible to obtain a complete cast of the brain-cavity of this interesting dinosaur.

Two long splints of bone which extend from the premaxillæ to the front of the external nares, joining along the midline, were supposed by Marsh to be processes of the premaxillæ. Dr. Holland regards them as distinct bones and suggests that they are the lateral ethmoids. It would be interesting to learn how the lateral ethmoids could migrate from the prefrontal region and come to lie on the midline in front of the nostrils. It is very doubtful whether the splints are distinct from the premaxillæ.

The bone called the presphenoid by Dr. Holland is the parasphenoid.

As is well known, the nostrils of *Diplodocus* lie far toward the rear of the skull, between the orbits. On each side of the face, far in front of the orbits, there is found a fontanel in each maxillary bone. This opens into the cavity above the pterygoid bones. Dr. Holland suggests that these openings were probably a pair of supplementary nostrils. From what we know about the development of the rectum it is imaginable that a nasal passage might divide into two passages, and that one of these might remain in its place while the other, with its external opening, might migrate to where we find it in *Diplodocus*. But had this happened in *Diplodocus* the nostril that retained its primitive position would be represented by one of the two clefts found near the midline at the front of the long premaxillary splints already mentioned, which clefts, as Dr. Holland says, opened into the nasal passages. If then the maxillary fontanels were also supplementary nostrils, we should have an animal with three pairs of nostrils. As to those in the maxillæ, it would, I think, be difficult to explain their morphogeny. We must certainly look on the proposition as a fanciful one. I see no reason to doubt that the fontanels in the maxillæ were in life filled with connective tissue and covered over by the skin.

In a foot-note Dr. Holland informs us that certain groups of reptiles have no external ears and that *Diplodocus* probably lacked these organs; but we should like to know what reptiles do have external ears.

In nearly all of Dr. Holland's references to the two skulls of *Diplodocus* in the U. S. National Museum he gets the numbers 2672 and 2673 exchanged. Apparently only the reference on page 239 is correct. On page 235 he credits to the U. S. National Museum two specimens that are in the American Museum of Natural History, New York, Nos. 545 and 969.

OLIVER P. HAY

THE SPREADING OF MENDELIAN CHARACTERS

THE point made by Mr. Hardy in his note on "Mendelian Proportions in a Mixed Population" in SCIENCE of July 10, 1908, is a very important one, though it is open to a dangerous misunderstanding. What Mr. Hardy gives us is a mathematical proof that *under the assumptions of Mendelian inheritance* a dominant character does not tend to spread or a recessive character to die out. A *strictly Mendelian* character would not tend either to increase or diminish its representation in a species, unless favored or opposed by selection. This is a mathematical confirmation of the biological evidence that Mendelism has no relation to evolution.

Nevertheless, the proviso of strict Mendelian inheritance robs the demonstration of a truly biological significance and forbids us to rely on it as a protection against the spread of brachydactyly or other abnormal characters in man himself or in our domesticated plants and